

GOVERNMENT OF INDIA
METEOROLOGICAL DEPARTMENT

INDIA WEATHER REVIEW, 1953

Annual Summary

PART C

STORMS AND DEPRESSIONS

QC
990
I39
I529
pt. C
1953

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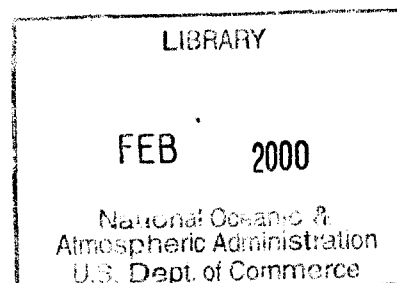
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Published by the Authority of the Government of India

Under the Direction of

S. Basu, M.Sc., F. N. I.

Director General of Observatories



PRINTED IN INDIA, BY THE MANAGER, GOVT. OF INDIA PRESS, NASIK ROAD
PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI : 1958

Price: Rs. 10-18-00

13487M. 22754.9 cl.

National Oceanic and Atmospheric Administration

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INDIA WEATHER REVIEW, 1953

ANNUAL SUMMARY

Part C

STORMS AND DEPRESSIONS

I. DEPRESSIONS AND CYCLONIC STORMS

During the year, 2 cyclonic storms and 9 depressions formed in the Bay of Bengal and one depression over land. There were no storms or depressions in the Arabian Sea. The periods of activity of the 2 cyclonic storms and the greatest barometric depth observed or estimated in their fields are given below :

TABLE I

S. No.	Region	Month	Period of activity	Greatest observed (or estimated) barometric depth
1	Bay of Bengal	April-May	29th April to 1st May.	16 mbs. (estimated)
2	Do.	July-Aug.	29th July to 5th August.	19 mbs.

Detailed descriptions of the storms and depressions are given below, followed by a list of western disturbances and a brief account of the more important ones among them. Local storms and occasions when wind force of 9 or more, unconnected with cyclonic storms, were reported by ships in the Indian Seas have also been listed in the end.

1. Deep depression in the Bay of Bengal—27th to 30th January 1953.—A low pressure wave from the east was noticed moving westwards across Tennasserim coast on the 25th morning. Pressures were falling over Tennasserim and the Bay Islands and Victoria Point recorded 3" of rain. On the next day, the low pressure wave moved into the south Andaman Sea. Nancowrie recorded 3" of rain and Victoria Point another 1½". A well-marked low pressure area formed in the south Andaman Sea on the 27th morning, when Nancowrie recorded another 2" of rain. By the evening, the low pressure area got accentuated. At 1730 hrs. I.S.T. S.S. Loksang (Lat. 7° 9'N., Long. 96° 3'E.) reported squally weather and southsoutheasterly wind, 6 B.F. while S.S. Celebes (Lat. 5° 8'N., Long. 92° 8'E.) reported north-northwesterly wind, 5 B.F. By the 28th morning, a depression formed with its centre at 0830 hrs. I.S.T. near Lat. 9°N., Long. 96°E. The pressure at the centre was estimated to be about 1000 mbs., about 6 mbs. in defect. S.S. Loksang (8° 4'N., 96° 5'E.) reported west-northwesterly wind, 7 B.F. at 0530 hrs. I.S.T. and S.S.

Roebia (10°N., 96°E.) reported east-southeast, 4 B.F. at 1130 hrs. I.S.T. By evening, the depression had moved northwest and was centred near Lat. 9½°N., Long. 95°E. It then moved in a northerly direction and intensifying into a deep depression, was centred at 0830 hrs. I.S.T. of 29th near Lat. 11½°N., Long. 95°E. The deepening of the depression was indicated by the strengthening of upper winds at Tavoy, which was southeast, 30-35 knots between 3000 and 10,000 ft. a.s.l. on 29th morning. The estimated pressure deficiency at the centre was about 8 mbs. Recurving and moving rapidly in a north-northeasterly direction and weakening at the same time, it was centred on the morning of 30th about 100 miles south of Rangoon. It crossed the Burma coast between Rangoon and Moulmein during the course of the day and weakening further, moved away northeastwards as a low pressure wave.

2. Cyclonic storm in the Bay of Bengal—29th April to 1st May 1953.—A trough of low pressure appeared over the southeast Bay of Bengal and neighbourhood on 28th April. Widespread rain was reported from the Bay Islands and the south Tennasserim coast. Pressures commenced falling rapidly over the south Tennasserim and the Bay Islands. By 29th morning, the trough became well-marked, the pressure departures over the Bay Islands being of the order of 4 mbs. A cyclonic circulation was noticed in the south Bay and neighbourhood up to 10,000 ft. and there was a strengthening of the upper winds over the Tennasserim, the widespread rainfall over the Bay Islands and the south Tennasserim. By the evening of the same day, the well-marked trough concentrated into a depression centred at 1730 hrs. I.S.T. near Lat. 12½°N. and Long. 91°E., as inferred from the following observations.

1. Port Blair upper winds veered from northeast to southeast and strengthened considerably up to 7,000 ft.
2. There was a rise of pressure along the Martaban and the north Tennasserim coast and concentrated fall of pressure in the Andaman Islands, pressure departure at Port Blair being of the order of—5 mbs.
3. There was a decrease in the intensity of rainfall in the southern parts of the Bay Islands and along the Tennasserim coast, while the intensity

of rainfall increased in the northern parts of the Bay Islands, Table Island reporting 3" during the period 0830 to 1730 hrs. I.S.T.

4. At 1730 hrs. I.S.T. Car Nicobar reported south-westerly wind, 5 knots, Port Blair southwest—15 knots and Ship S.S. Rajula ($8^{\circ}30'N.$, $86^{\circ}48'E.$) west—5 knots.

The estimated pressure at the centre of the depression was 998 mbs., 6 mbs. below normal. Moving north-eastwards, the depression concentrated rapidly into a cyclonic storm at 0830 hrs. I.S.T. of 30th became severe and was centred near Lat. $14\frac{1}{2}^{\circ}N.$, Long. $92^{\circ}E.$ It had probably a small core of hurricane winds. Pressure fall over the northern parts of the Bay Islands was of the order of—10 mbs. and the maximum deficiency of pressure was estimated to be of the order of 16 mbs. at the centre of the storm. S.S. Singu ($16^{\circ}48'N.$, $92^{\circ}42'E.$) reported easterly—35 knots with rain and Table Island southwest—10 knots with continuous rain. Port Blair and Table Island reported squalls of 45 knots and 40 knots at 0140 and 0530 hrs. I.S.T. respectively. Widespread heavy rain was reported from the Bay Islands, Table Island reporting 9", Long Island 4", Mayabandar 3" and Port Blair 2". The severe cyclone continued to move in a northeasterly direction. At 1730 hrs. I.S.T. of 30th, a rise of pressure over the Bay Islands, and a concentrated fall over Martaban were noticed. Bassein reported 4" and Rangoon 2" of rain during the period 0830 hrs. to 1730 hrs. I.S.T. The cyclone was centred at 1730 hrs. I.S.T. near Lat. $15\frac{1}{2}^{\circ}N.$, $93\frac{1}{2}^{\circ}E.$ The following observations of S.S. Singu and Table Island on the 30th are relevant in this connection.

TABLE 2

Ship/Station	Position		Hours of obsn.	Wind Direction	Speed (knots)	Weather remarks
	Lat. °N	Long. °E				
S. S. Singu	$16^{\circ}36'$	$93^{\circ}0'$	1130IST	E	30	
Do.	$16^{\circ}24'$	$93^{\circ}12'$	1330IST	NE	30	
Do.	$16^{\circ}12'$	$93^{\circ}0'$	1530IST	NE	25	
Do.	$16^{\circ}12'$	$92^{\circ}36'$	1730IST	NE	20	Precipitation within sight
Table Island	..	..	1330IST	SW	35	Drizzling
Table Island	..	..	1730IST	WNW	15	

The estimated pressure defect at 1730 hrs. at the centre of the storm was about 12 mbs.

Thereafter, the cyclonic storm moved northeastwards and showed signs of weakening. It was centred near Diamond Island at 0530 hrs. of 1st May, when Table Island reported westerly winds—15 knots. By 0830 hrs. I.S.T. of the same day, the cyclonic storm weakened into a depression passed inland near Diamond Island and lay as a low over Pegu and neighbourhood. Widespread rain was again reported from the Bay Islands on the 1st. Widespread and locally very heavy rain was also reported from lower Burma on the morning of 1st May. Some noteworthy amounts of rainfall recorded by Burma stations on the 1st May are—Maubin and Pegu 7" each, Promé and Rangoon 5" each.

3. Deep depression in the Bay of Bengal—14th June and 20th June 1953.—On the morning of 14th June, the eastern end of the monsoon trough extended into the central Bay of Bengal across the Orissa-Circars coast. There was also a marked strengthening of both the branches of the monsoon, Rangoon reporting 8" of rain and Akyab 4" during the 24 hours ending at 0830 hrs. I.S.T. of 14th. On the next day, conditions became markedly unsettled in west central and adjoining north Bay of Bengal. The associated upper air cyclonic circulation extended up to 10,000 ft. a.s.l. and pressures were falling along the Circars coast. On the morning of 16th, a depression formed with its centre at 0830 hrs. I.S.T. within half a degree at Lat. $17\frac{1}{2}^{\circ}N.$, Long. $86\frac{1}{2}^{\circ}E.$ The following observations are significant in this connection.

TABLE 3

Station	Position	Time of Obsn. IST	Wind	Weather
Ship				
S. S. Shield Bank.	Lat. $15.6^{\circ}N.$ Long. $86.5^{\circ}E.$	0530 hrs.	SW—20 kts.	Showers
S. S. British Swordfish	Lat. $16.1^{\circ}N.$ Long. $88.0^{\circ}E.$	0530 hrs.	SW—15 kts.	..
Visakhapatnam		0830 hrs.	NNW—5 kts.	..

A rise of pressure was observed along the south Circars coast, while along the Orissa-West Bengal coasts pressures fell and the rainfall increased. Moving slowly in a northerly direction the depression was centred within half a degree of Lat. $18\frac{1}{2}^{\circ}N.$, Long. $86\frac{1}{2}^{\circ}E.$ at 0830 hrs. I.S.T. of the 17th. Continuing to move in a northerly direction and intensifying, it became a deep depression on the morning of 18th, centred at 0830 hrs. I.S.T. about 50 miles southeast of Puri. Thereafter it took a west-northeasterly course and was centred on 19th morning about 30 miles southsouthwest of Puri. The following observations are significant in this connection.

TABLE 4

Station/Ship	Position		Hour of obsn. IST	WIND		Weather
	Lat. °N	Long. °E		Dirn.	Speed	
S. S. Jalajyoti	16.1	85.1	1130	SW	40 kts.	Drizzle
S. S. Mahadevi	17.4	84.5	0530	WSW	30 kts.	Drizzle in last hour.
S. S. Mahadevi	18.4	85.6	1130	WSW	30 kts.	
Puri	..	..	0830	ENE	25 kts.	
Puri	..	..	1130	SE	20 kts.	
Gopalpur	..	..	0830	NNW	10 kts.	Continuous drizzle.
Gopalpur	..	..	1130	NNW	10 kts.	Heavy rain.

The pressure deficiency at Puri and Gopalpur was about 10 mbs. on 19th morning and the estimated pressure deficiency at the centre of the deep depression was about 12 mbs. During the course of the day, the deep depression showed signs of weakening and pressures

began to rise along the Orissa coast. By 1730 hrs. I.S.T. it weakened into a depression and was crossing the coast between Puri and Gopalpur. Continuing to move in a westnorthwesterly direction, it lay with its centre near Titilagarh on the morning of 20th. Thereafter it weakened further and merged into the seasonal monsoon trough.

Under the influence of the deep depression, fairly widespread rain occurred in Orissa, West Bengal, Chota Nagpur, Bihar and east Madhya Pradesh during the period 16th to 20th, June. The following table gives the district averages and particularly heavy amounts of rainfall in the affected areas. Rainfall figures for Orissa are not available.

TABLE 5

State and District	District averages on							Particularly heavy falls
	14th	15th	16th	17th	18th	19th	20th	
<i>West Bengal</i>								
Jalpaiguri	1.3	
Cooch Behar	2.0	
<i>Bihar</i>								
Patna	1.0	..	..	..	..
Saran	1.5	2.1	..	..	..	..	..	On 14th-Siwan 5.0" On 15th-Gopalganj 5.1" Darauli 5.2"
Champaran	1.2	1.6	..	..	..	..
Muzaffarpur	1.8	1.3	..	..	..	..	On 15-Balsand 5.9
Saharsa	1.9	..	..	..	..	..	..
<i>Madhya Pradesh</i>								
Raipur	1.3	..	..	On 16th-Dhamtari 5.1"
Bastar	1.7	3.0	..	On 20th-Bijapur 5.0", Konta 7.5", Sukma 5.3"
Chanda	1.3	
Wardha	1.3	
Akola	1.2	
Buldhana	2.3	
Ycetmal	1.1	

4. Shallow depression in the Bay of Bengal—29th and 30th June 1953.—With the arrival of a low pressure wave from the east, conditions became unsettled in the head Bay of Bengal on the morning of the 28th June. Surface winds at Saugor Island were eastnortheast—15 knots while at Sandheads they were westsouthwest—15 knots. A simultaneous strengthening of the Arabian Sea branch of the monsoon was noticed. On the 29th morning, a well-marked low pressure area appeared over the northwest angle of the Bay and adjoining coastal West Bengal and Orissa, with an associated upper air circulation extending up to 10,000 ft. a.s.l. Sandheads recorded 4" of rain and surface winds westsouthwest—30 knots. By the early morning of the 30th, a shallow depression formed with centre at 0130 hrs. I.S.T. about 100 miles south of Calcutta. Sandheads recorded southwest—20 knots and Saugor Islands northnortheast—3 knots. Sandheads recorded a pressure deficiency of about 8 mbs. Pressures were falling over northwest angle of the Bay but had commenced rising in the surrounding areas. At 0830 hrs. I.S.T. on the same morning, the shallow depression was centred close to coast about 50 miles south of Calcutta. By the evening it weakened and lay as a diffuse low over Gangetic West Bengal and adjoining areas of Chota Nagpur.

In association with this depression, widespread rain with locally heavy falls occurred in the coastal districts of West Bengal and Orissa and in Chota Nagpur on the 29th and the 30th.

A statement showing the district averages and noteworthy amounts of rainfall in West Bengal and Chota Nagpur associated with the depression is given below. Rainfall figures from Orissa are not available.

TABLE 6

State and district	District averages on		Particularly heavy falls.
	29th	30th	
<i>West Bengal</i>			
Nadia	2.2	..	
Midnapore	1.3	..	On 29th-Jhargram 5.3"
<i>Chota Nagpur</i>			
Ranchi	1.0	1.1	
Manbhum	1.4	1.1	On 29th-Barabazar 8.4" On 30th-Barabazar 7.8"
Singhbhum	2.2	1.7	On 29th-Jamshedpur 6.1" On 30th-Jamshedpur 8.4"

5. Cyclonic storm in the Bay of Bengal—29th July to 5th August 1953.—On the 29th July, the monsoon trough was observed to have extended well into the central Bay through the north Circars coast and a shallow low was noticed over the central and adjoining north Bay. There was also a strengthening of the monsoon in the south Bay, lower Burma and Tennasserim, Victoria Point recording 12" of rain, Car Nicobar 3" and Maya Bandar 2" during the 24 hours ending at 0830 hrs. I.S.T. of 29th. The shallow low persisted over the central Bay and adjoining north Bay till the 31st July without any appreciable intensification. On both

these days, the monsoon continued active over the south Bay and lower Burma and fairly widespread rain with locally heavy falls occurred over the Bay Islands, Ténasserim and Martaban coast; whereas there was a considerable decrease of rainfall over northeast India—particularly over Assam and adjoining West Bengal and east Pakistan. Some significant amounts of rainfall reported on the 30th and 31st are—Tavoy 6" on 30th; Car

Nicobar and Long Island 2" each on 30th. Tavoy 5" on 31st; Port Blair, Table Island and Bassein 2" each on 31st.

By the morning of the 1st August, the axis of the monsoon trough shifted to the north and the monsoon strengthened over the central Bay and Arakan. The following observations are significant in this connection.

TABLE 7

Station/Ship	Position	Time of obsn.	of IST	Wind		Weather remarks
				Direction	Speed (kts.)	
S. S. Socotra	$\begin{cases} 15^{\circ}24'N \\ 87^{\circ}18'E \end{cases}$	0500		W.	30	Showers in last hour.
Table Island		0830		SSW	25	
Sandheads		0830		NW	10	Drizzle
Cox's Bazar		0830		SE	5	

Pressures began to fall in and around the Head Bay, whereas they began to rise over the Martaban and south Arakan coast. At 0830 hrs. I.S.T. of the 1st, a depression formed with centre near Lat. $20^{\circ}N.$, Long. $89\frac{1}{2}^{\circ}E.$ The depression moved slowly northwestwards, deepening at the same time. At 0130 hrs. I.S.T. of 2nd, the pressure departure at Sandheads was of the order of —11 mbs., indicating that it had probably concentrated into a cyclonic storm of small core with centre at that hour near Lat. $21^{\circ}N.$, Long. $88\frac{1}{2}^{\circ}E.$ The following observations of 2nd are relevant in this connection—

TABLE 8

Station	Time of obsn.	of IST	Wind		Weather	remarks
			Dirn.	Speed (kts.)		
Sandheads	0130		NW	25		
Saugor Island	0130		NNE	20	Raining	
Balasore	0130		NW	15		

By 0215 hrs. I.S.T. wind speed at Saugor Islands increased to 30 knots, the gust speed, being 45 knots. This also confirms the intensification of the depression into a storm.

The cyclonic storm remained practically stationary till 0530 hrs. I.S.T. of the same day. At that hour, Sandheads reported northwesterly winds—30 knots and Calcutta northeasterly—20 knots. There was a concentrated fall of pressure in and near the northwest angle of Bay and a rise of pressure along East Pakistan and Arakan coasts; the pressure departure at Sandheads was —19 mbs. while the departures along the East Pakistan and Arakan coasts were between—1 to 1 mb. After 0530 hrs. I.S.T., the cyclonic storm moved slowly west-northwestwards and at 0830 hrs. I.S.T. it was centred about 90 miles southsouthwest of Calcutta. At that time, Sandheads reported southerly winds 15 knots, Saugor Island eastnortheast—30 knots and Balasore north—15 knots; Akyab recorded 9" of rain, Sandheads 3" and Saugor Island and Puri 2" each during the 24 hours

ending at 0830 hrs. of the day. The rainfall over north-east India had increased generally and was fairly widespread over the area. The pressure departure at Sandheads was still of the order of—17 mbs. and the upper winds over Gangetic West Bengal, Pakistan and lower Assam showed a general strengthening with cyclonic circulation over the northwest angle of the Bay and neighbourhood up to 10,000 ft. a.s.l. By the evening of the same day, the cyclonic storm was close to coast near Balasore and showed signs of weakening. At 1130 hrs. Saugor Island had reported easterly winds—40 knots and Sandheads southerly—40 knots, while at 1730 hrs. Saugor Island reported easterly winds—30 knots and Sandheads southerly—15 knots. The pressure departure at the centre of the storm had decreased to about—11 mbs. at 1730 hrs. I.S.T. The storm crossed the Orissa coast to the south of Balasore during the night, weakened and lay at 0830 hrs. I.S.T. of 3rd as a deep depression over Orissa with its centre near Sambalpur. At that time, the pressure departure at the centre of the depression was of the order of—12 mbs.; Jharsuguda reported northeasterly winds—20 knots, Angul southeast—20 knots, Gopalpur southwest—30 knots. Widespread moderate to heavy rain was reported from stations in south and east Orissa and adjoining West Bengal districts. Angul recorded 10", Chandbali 5", Saugor Island, Titilagarh and Cuttack 4" each and Balasore and Gopalpur 2" each. By the evening of the same day, the deep depression weakened and moving westwards was centred at 1730 hrs. I.S.T. near Raipur. The depression continued to move westnorthwestwards causing widespread and locally heavy rain in north Orissa, Madhya Pradesh and adjoining areas. It was centred on the morning of 4th about 80 miles southeast of Jabalpur. Thereafter it weakened further, moved westwards and was centred on the morning of 5th over northwest Madhya Pradesh, about 40 miles northwest of Jabalpur. On the 5th evening, it lay as an extended trough over north Madhya Bharat and adjoining east Rajasthan. Widespread and locally heavy rain occurred in south Madhya Pradesh on 4th, northwest Madhya Pradesh on the 5th and Madhya Bharat on 6th.

A statement of district averages and noteworthy amounts of rainfall associated with the storm is given below. Rainfall figures from Orissa are not available.

TABLE 9

State and District	District averages on								Particularly heavy falls
	J U L Y			A U G U S T					
	29th	30th	31st	1st	2nd	3rd	4th	5th	
<i>West Bengal</i>									
24 Parganas	1.2	1.2	..	..
Nadia	1.0	1.6	3.4	..	..	On 3rd August—Haringhata 6.6"
Jalpaiguri	1.3	
Howrah	1.2	..	..
<i>Chota Nagpur</i>									
Hazaribagh	1.0	..	..
Manbhum	1.0	1.1	..	..
<i>Madhya Pradesh</i>									
Durg	3.9	1.0	On 4th Aug.—Ambagarh Chowki 11.9", Khapri 5.0", Adamabad 7.4", Bhatgaon 5.5", Selod 5.3", Rajnangaon 7.2".
Raipur	2.1	3.7	..	On 4th Aug.—Raipur 5.0", Arang 5.1", Kurud 6.4", Lakholi 5.7", Rudri 5.1", Maransilli 6.3", Ghattasilli 5.7".
Bastar	1.8	4.6	..	On 4th Aug.—Antagarh 10.0" Bijapur 6.1", Keskal 5.7", Narayanpur 6.3", Kanker 6.6", Bhanupratappur 5.5".
Surguja	1.1	..	..	..
Chanda	3.0	5.7	2.9	On 3rd Aug.—Mul 5.0", Brahmpuri 12.0", Armori 7.4", Ahira 6.0", Dhanora 7.1". On 4th—Brahmapuri 5.6", Chimur 6.7", Gadhchiroli 7.6", Asola 7.5", Ghorajheri 7.9", Khairce 8.0", Kunghari 7.1", Nalesar 6.5", Garmuzi 7.3", Sindhewahi 7.3". On 5th—Asola 6.2", Ghorajheri 7.5", Khairce 5.3", Nalesar 5.4".
Bhandara	1.0	3.4	4.8	On 4th Aug.—Sakoli 5.0", Paoni 7.2", Deori 5.5", On 5th—Bhandara 6.1", Sakoli 5.3", Gondia 5.7", Chandpur 5.3", Bodalkasa 5.1", Chorkhamara 6.5", Paoni 6.0".
Balaghat	1.3	1.8	3.3	On 5th Aug.—Katangi 5.4", Jamunia 5.5".
Hoshangabad	1.3	..	..	..	1.0	2.2	3.6	On 3rd Aug.—Makrai 7.2". On 4th—Harda 5.7". On 5th—Hoshangabad 5.4", Seoni 6.7", Pachmarhi 8.1".
Nimar	1.7	3.2	
Betul	4.0	4.1	On 4th Aug.—Chicholi 5.0", Betul (obsy.) 5.0".
Chhindwara	1.3	5.0	On 5th Aug.—Sausar 5.2", Harrai 7.2", Tamia 7.3", Amarwara 5.7", Seoni 6.1", Lakhandon 7.1", Ari Tank 5.4", Chich 5.1".
Nagpur	1.8	3.2	On 4th Aug.—Umrer 6.8". On 5th—Nagpur 5.5", Umrer 6.8", Ramtek 8.0", Khindri 7.2", Deolapar 6.0", Parsoni 6.3".
Wardha	3.5	3.1	
Akola	1.0	1.3	
Amraoti	1.7	2.6	On 1st Aug.—Chikalda 11.7".
Buldhana	1.3	..	..	..	..
Yeotmal	1.2	..	..	..	1.6	1.9	

6. Depression in the Bay of Bengal—9th to 14th August 1953.—On the 7th, a low pressure wave was noticed to be moving into the north Bay of Bengal across Burma. Pressures were falling along the Arakan-Chittagong and West Bengal coasts. By the next morning, the axis of the monsoon trough extended into the head Bay where conditions became unsettled. An upper air cyclonic circulation extending up to 10,000 ft. a.s.l. had already developed over the head Bay and adjoining land areas. Widespread rain occurred in northeast India with locally heavy falls in and around Chota Nagpur. Pressures continued to fall in and near the coastal areas of north Bay and by the morning of 9th, a pressure deficiency of the order of 2 to 3 mbs. was observed over the head Bay; simultaneously, a decrease of rainfall was noticed in Assam and Eastern Pakistan. By the 10th morning, a depression formed with centre at 0830 hrs. I.S.T. near Lat. 20°N. , Long. $89\frac{1}{2}^{\circ}\text{E.}$; Sandheads reported northnorthwesterly winds—10 knots, Saugor Island northeast—15 knots and Noakhali southeast—5 knots at that hour. The depression moved westwards and was centred at 0830 hrs. I.S.T. of 11th near Lat. 20°N. , Long. $88\frac{1}{2}^{\circ}\text{E.}$ Pressures continued to fall around the head Bay and a pressure deficiency of about 7 mbs., was observed at Sandheads on that morning. Sandheads recorded northeasterly winds—5 knots, Saugor Island northnortheast—15 knots, S.S. Makala ($20^{\circ}30'\text{N.}$, $87^{\circ}30'\text{E.}$) reported northnorthwest—11 knots at 0530 hrs. I.S.T. Further south, S.S. City of Khartoum ($16^{\circ}48'\text{N.}$, $86^{\circ}18'\text{E.}$) reported westerly winds—45 knots indicating that the monsoon was vigorous to the south of the depression. Widespread rain continued in Chota Nagpur, West Bengal and coastal areas of Orissa but rainfall had practically ceased in Assam and in the inland districts of West Bengal and Bihar. By 1730 hrs. I.S.T. of the same day (11th), the depression had moved slightly west and was centred near Lat. 20°N. , Long. 88°E. ; Sandheads recorded easterly winds—15 knots, Saugor Island eastnortheast—25 knots, Puri northwest—5 knots, S.S. Makala ($19^{\circ}18'\text{N.}$, $88^{\circ}6'\text{E.}$) westnorthwest 13 knots. The monsoon continued to be vigorous to the south of the depression as indicated by further observations of S.S. Khartoum ($14^{\circ}54'\text{N.}$, $86^{\circ}6'\text{E.}$) reporting westerly 38 knots at 1730 hrs. I.S.T. of 11th. The depression remained stationary and intensified further by the next morning, when Sandheads reported a pressure deficiency of over 8 mbs. The deficiency at the centre of the depression might have been of the order of 10 mbs. At 0830 hrs. I.S.T. of 12th, Sandheads recorded easterly winds 20 knots and Saugor Islands eastnortheast—20 knots. S.S. Clandavidson (Lat. 19.1°N. , Long. 86.8°E.) reported westerly winds—15 knots at 0530 hrs. I.S.T. and the same ship (20°N. , $87^{\circ}5'\text{E.}$) reported easterly—15 knots at 1130 hrs. I.S.T. The centre of the depression at 0830 hrs. I.S.T. was within half a degree of Lat. 20°N. , and long. $87\frac{1}{2}^{\circ}\text{E.}$ The depression remained practically stationary till the morning of 13th. Later it weakened into an elongated trough of low pressure extending from the Sunderbans to the Orissa coast in the evening of 13th. Sandheads reported southsoutheasterly winds—10 knots, Saugor Islands eastnortheast—15 knots and Chandbali northeast—5 knots. The trough persisted there till the 14th morning and weakening further, passed inland across the north Orissa coast during the course

of the day. It lay as a shallow low over Orissa, Chota Nagpur and east Madhya Pradesh on the 15th and became unimportant thereafter.

In association with the depression, fairly widespread rain occurred in Chota Nagpur, Gangetic West Bengal, Orissa and central parts of the country between 13th and 15th.

Statement of district averages and noteworthy amounts of rainfall associated with the depression is given below. Rainfall figures for Orissa are not available.

TABLE 10

State and District	District		Averages on				Particularly heavy falls
	9th	10th	11th	12th	13th	14th	
<i>Chota Nagpur</i>							
Hazaribagh	1.0	
Palamau	1.3	..	
Manbhum	1.0	

7. Land depression—22nd to 24th August 1953.—

On the morning of 22nd, a low pressure wave was noticed moving from east through Upper Burma and Eastern Pakistan. Pressures were falling rapidly over Upper Burma and Eastern Pakistan, while there was a rise along upper Assam and Lower Burma. Pressure departures were of the order of—8 mbs. along north Chittagong coast. There was a strengthening of the monsoon along Arakan and Chittagong coasts. Sando-way reported 10" of rain, Bassein and Noakhali 4" each and Akyab 3" during the 24 hours ending at 0830 hrs. of 22nd. By the evening of the same day, conditions became unsettled in the northeast angle of the Bay. A fall of pressure was observed over deltaic West Bengal and north Arakan coast and a rise elsewhere in northeast India and Burma. By the morning of the 23rd, the unsettled conditions moved westwards and a land depression formed with centre at 0830 hrs. I.S.T. about 30 miles southsouthwest of Calcutta. Saugor Island reported westsouthwesterly winds—25 knots, Sandheads west-southwest—15 knots, Calcutta east—5 knots and Khulna southeast—5 knots. There was strengthening of the monsoon over the north and central Bay of Bengal and moderate to heavy rain occurred along the West Bengal coast. By the evening of the same day, the depression weakened and moving westnorthwestwards was centred at 1730 hrs. I.S.T. near Jamshedpur. The pressure departure at that hour was of the order of—8mbs. near its centre. Midnapore reported southerly winds—5 knots and Purulia northeast—5 knots. The heavy rainfall belt moved westnorthwestwards; Jamshedpur and Chaibasa reported 4" each, Chandbali, Dhanbad, Purulia and Gaya 2" each during the period from 0830 hrs. I.S.T. to 1730 hrs. I.S.T. of 23rd.

By the morning of the next day, the depression weakened further and moved away northwestwards as a low pressure wave. During the passage of the low, widespread and locally heavy rain occurred over Chota Nagpur and Bihar. A statement of district averages and noteworthy amounts of rainfall associated with the depression is given below.

TABLE 11

State and District		District averages on			Particularly heavy falls								
		22nd	23rd	24th									
Bihar													
Patna	1.5	..	On 24th—Gaya 5.9", Jahanabad 6.1", Arwal 8.6", Sherghati 6.9", Barachait 6.7".
Gaya	1.0	1.7	4.0	

TABLE 11—*contd.*

State and District	District averages on			Particularly heavy falls
	22nd	23rd	24th	
<i>Bihar—contd.</i>				
Shahabad	2.7	1.0	2.3	On 22nd—Arrah 5.0". On 23rd—Sikraul 5.0". On 24th—Ramnagar 5.1", Manoharpur 5.0".
Saran	2.5	2.2	1.4	On 24th—Katiya 6.0".
Monghyr	1.3	..	..
Saharsa	1.4	..	..
<i>Chota Nagpur</i>				
Hazaribagh	1.1	2.1	3.1	On 23rd—Hunterganj 5.4", Tandwa 5.0", Bishnugarh 5.6", Barakhata 5.4", Barka- gaon 5.0", Kanar 5.7".
Ranchi . . . . .	..	1.7	2.4	On 24th—Tamar 7.1"
Palamau	1.0	..	1.9	
Manbhum	1.4	..	2.3	On 24th—Jhaldah 5.4", Chandil 10.0", Baghmundi 5.6".
Singbhum . . . . .	..	1.3	3.5	On 24th—Jamshedpur 6.7", Manohar- pur 5.4", Seraikella 6.2".
<i>Uttar Pradesh</i>				
Agra . . . . .	..	..	1.3	
Bareilly . . . . .	..	2.0	1.0	
Shahjahanpur . . . . .	..	3.1	..	
Pilibhit . . . . .	..	3.3	1.3	On 23rd—Bisalpur 5.6".
Farrukhabad . . . . .	..	2.3	..	On 23rd—Kannauj 5.0".
Etawah	1.1	..	2.8	
Jalaun	1.9	..	1.5	
Tehri Garhwal . . . . .	..	..	1.5	
Kanpur . . . . .	..	4.2	2.2	On 23rd—Kanpur (Obsy.) 6.3", Kan- pur 7.3", Bilhanur 6.5".
Fatehpur . . . . .	..	7.6	2.6	On 23rd—Khajwa 5.5", Khaga 9.8".
Allahabad . . . . .	..	4.8	..	On 23rd—Allahabad 6.1", Allahabad (Obsy.) 8.3", Sirathu 5.8", Manj- hanpur 5.1", Soraon 5.4", Phul- pur 5.0".
Hamirpur	1.0	..	..
Banda . . . . .	..	3.3	..	On 23rd—Baberu 6.9", Mau 6.9".
Banaras	2.2	1.3	2.0	
Mirzapur	1.0	..	..
Jaunpur	2.8	3.7	2.3	On 23rd—Machhlishahr 5.8".
Ghazipur	3.5	1.5	5.7	On 24th—Ghazipur 5.0", Zamania 6.0", Muhammadabad 7.5".
Ballia	6.2	1.1	2.7	On 22nd—Rasra 9.5", Bansdih 5.6", Sikandarpur 5.0".
Gorakhpur	2.2	1.6	1.0	
Deoria	3.8	1.3	1.1	
Basti	1.6	1.3	..	
Azamgarh	6.2	1.6	3.9	On 22nd—Azamgarh 5.1", Deogaon 8.0", Jiwanpur 7.2", Muhammadabad 8.5", Ghosi 6.2". On 23rd—Mahul 6.1". On 24th—Ghosi 5.0".
Lucknow	1.3	..	..
Unnao . . . . .	..	3.1	..	
Rae Bareilly . . . . .	..	3.9	..	On 23rd—Dalmau 5.1", Saon 5.0".
Sitapur . . . . .	..	1.7	..	
Hardoi . . . . .	..	3.9	..	
Kheri . . . . .	..	3.0	..	
Faizabad	1.0	2.1	2.0	
Gonda	1.4	1.1	..	
Sultanpur	1.4	4.6	1.4	On 23rd—Kadipur 8.0".
Pratapgarh	3.6	5.5	1.1	On 23rd—Kunda 9.0".

8. Shallow depression in the Bay of Bengal—6th to 9th September 1953.—A shallow low pressure area developed over the northwest and adjoining west central Bay in the beginning of September. With the movement of a low pressure wave from east, this low became accentuated and on the morning of 6th, conditions became unsettled in the northwest and adjoining west central Bay. S.S. Clan Maclean ($18^{\circ} 30'N.$, $89^{\circ} 30'E.$) reported

southerly winds—12 knots at 0530 hrs. I.S.T. and Sandheads and Puri reported eastsoutheast—10 knots and northeast—5 knots respectively at 0830 hrs. I.S.T. By the morning of 7th, a shallow depression formed in the northwest angle of the Bay centred at 0830 hrs. I.S.T. near Lat. $20^{\circ}N.$, Long. $87\frac{1}{2}^{\circ}E.$ The following observations are significant in this connection.

TABLE 12

Name of ship/station	Position	Hour of obs. IST	Wind		Remarks
			Direction	Speed	
S. S. Maharaja	$\left\{ \begin{array}{l} 18^{\circ} 12'N \\ 89^{\circ} 18'E \end{array} \right.$	0530	SSW	16 kts.	Rain.
S. S. Shinwamaru	$\left\{ \begin{array}{l} 19^{\circ} 18'N \\ 89^{\circ} 54'E \end{array} \right.$	0530	S	15 kts.	Rain within sight.
Sandheads	--	0830	ESE	20 kts.	
Chandbali	--	0830	N	5 kts.	
Puri	--	0830	NNW	20 kts.	

The shallow depression moved northwestwards as it weakened and passing inland, lay as a diffuse 'low' over coastal West Bengal and neighbourhood on the 8th morning. It became unimportant thereafter. Under the influence of the depression, there was fairly widespread

rain with locally heavy falls in Gangetic West Bengal, Orissa, and Bihar on the 7th, 8th and 9th.

Statement of district averages and noteworthy amounts of rainfall associated with the depression is given below. Figures from Orissa are not available.

TABLE 13

State and district	District averages on				Particularly heavy falls
	6th	7th	8th	9th	
<i>West Bengal</i>					
24-Parganas . . . . .	..	..	1.0	1.1	
Nadia . . . . .	..	..	..	3.8	On 9th—Haringhata 6.8".
Murshidabad . . . . .	..	..	1.1	..	
West Dinajpur	1.2	..	..	1.2	
Jalpaiguri . . . . .	..	..	2.1	2.4	On 8th—Kaldini 7.9".
Darjeeling	1.5	1.4	1.1	2.1	
Malda . . . . .	..	..	..	6.2	On 9th—Gazole 10.5".
Cooch Behar . . . . .	..	..	..	1.1	
Howrah . . . . .	..	..	..	1.1	
<i>Bihar</i>					
Gaya . . . . .	..	..	..	1.2	
Saran	1.1	..	..	1.5	
Darbhangha	1.1	..	..	..
Purnea . . . . .	..	..	..	1.2	
Santhal Parganas . . . . .	..	1.3	..	1.1	On 7th—Amjara 7.5", Kundahi 5.5"
Ranchi . . . . .	..	..	..	1.3	On 9th—Itki 6.0".

9. Deep depression in the Bay of Bengal—23rd to 29th September 1953.—With the movement of a low pressure wave from the east, conditions became unsettled in the east central and adjoining north Bay on the 21st. Simultaneously the monsoon strengthened over the southeast and adjoining east central Bay. Widespread and locally heavy rain occurred in the Bay Islands and along the Burma coast, Table Island, Maya

Bandar and Port Blair recording 2" each, Tavoy 9" and Akyab 8". The unsettled conditions persisted on the 22nd and by the morning of 23rd, a depression formed with centre near Lat. $16^{\circ}N.$, Long. $91^{\circ}E.$ at 0830 hrs. I.S.T. The following observations of 23rd are significant in this connection.

TABLE 14

Name of station/ship	Position		Hour of obsn. IST	Wind		Weather
	Lat. °N	Long. °E		Direction	Speed (knots)	
S. S. Bharat Mitra	18.6	86.9	0530	NNE	5	
S. S. Jaladuta	14.0	85.6	0530	W	15	Occasional rain squalls.
S. S. Yoma	13.4	92.1	0530	WSW	15	Rain showers.
Table Island	..	..	0830	SW	20	

The upper winds at Port Blair at lower levels had backed from west to southwest, while those along the Chittagong-Arakan coasts backed from southwest to southeast and then to east. A large fall of pressure was observed around the central Bay, the pressure departure being about—3 mbs. along the Martaban coast and in the Andaman Islands.

The depression remained practically stationary till the evening of 23rd. Thereafter it deepened and moved westnorthwest. The deepening of the depression will be

evident from the fact that S. S. Jaladuta (Lat. 14.4°N., Long. 86.7°E.) reported winds of—30 knots from west-southwest and squally weather at 2330 hrs. I.S.T. The deep depression was centred at 0830 hrs. I.S.T. of 24th within half a degree of Lat. 16½°N and Long. 89½°E. The pressure deficiency at the centre of the depression was estimated to be of the order of 10 mbs.

The following observations recorded by ships on the 24th will be of interest.

TABLE 15

Name of the ship	Position		Hours of obsn. IST	Wind		Weather
	Lat. °N	Long. °E		Dirn.	Speed (knots)	
S. S. Bharat Mitra	15.0	85.4	0530	N	5	
S. S. Jaladuta	14.2	87.2	0530	WSW	27	Drizzling.
S. S. Choysang	20.0	89.4	0530	E	15	Raining.
S. S. Jaladuta	14.1	87.1	1130	WSW	30	Squally weather.
S. S. Jalaratna	19.3	86.5	1130	NE	15	

Taking a northnorthwesterly course, the deep depression moved into the north Bay and was centred at 0830 hrs. I.S.T. of 25th near Lat. 18½°N. and Long. 88°E. Pressure deficiency at the centre was estimated to be about 12 mbs. There was an appreciable rise of barometric pressure over Burma and the Bay Islands and a fall along West Bengal—Orissa coast. The deep depression moved northwards and was centred at 0830 hrs. I.S.T. of 26th about 30 miles to the southwest of Sandheads, the pressure deficiency at Sandheads being about 13 mbs. Under the influence of the deep depression, fairly widespread rain and gales occurred in the coastal districts of West Bengal and Orissa; Chandbali and Balasore reported 3" each on the 26th.

The deep depression continued to move in a northerly direction and crossed the coast during the night between Balasore and Saugor Island. It weakened thereafter and travelled northwestwards as a depression during the next two days. On the morning of 27th, it was centred near Chaibasa and on the next morning near Allahabad. On the 29th, it weakened into a trough of low pressure over the east Uttar Pradesh and subsequently became unimportant.

A statement giving the district averages and noteworthy amounts of rainfall associated with the depression is given below. Rainfall figures from Orissa are not available.

TABLE 16

State and district	District averages on					Particularly heavy falls
	23	24	25	26	27	
<i>West Bengal</i>						
24-Parganas	1.2	1.5	
Nadia	3.8	On 27th—Harin-ghata 6.0".
Jalpaiguri	1.1	
Darjeeling	2.2	..	..	1.5	1.3	On 26th—Kurseong 5.7".
Cooch Behar	1.1	
Burdwan	1.4	

TABLE 16—contd.

State and district	District averages on					Particularly heavy falls
	23	24	25	26	27	
<i>West Bengal—contd.</i>						
Birbhum	1.1	
Bankura	1.9	1.0	On 26th—Vishnu-pur 5.0". Saranga 5.1".
Hoogly	1.9	1.2	
<i>Bihar</i>						
Patna	On 25th—Bakhtiar-pur 5.0".
Saharsa	1.4	
Santhal Par-ganas	1.1	
<i>Chota Nagpur</i>						
Hazaribagh	2.0	On 26th—Peter-bar 5.1". On 27th—Gola 5.9".
Ranchi	1.4	2.4	On 26th—Palandu 5.9". On 27th—Ranchi 5.2".
Palamau	1.8	
Manbhum	2.1	On 26th—Jaipur 5.1". On 27th—Jhaldah 5.3". Chandil 5.3".
Singhbhum	3.3	On 27th—Chaibasa 6.1", Seraikela 5.9".

10. Depression in the Bay of Bengal—21st to 23rd October 1953.—With the arrival of a low pressure wave from the east across the Tennasserim coast, a shallow low pressure area formed over the south Andaman Sea on the 18th morning, when Victoria Point recorded 1½" of rain. The low shifted slowly westwards, as it accentuated. On the morning of 19th, the associated upper air cyclonic circulation was extending up to 10,000 ft. a.s.l. Simultaneously a feeble incursion of fresh equatorial maritime air took place into the southwest Bay;

S.S. Orange (Lat. 5.9°N., and Long. 89.0°E.) reported southerly wind—10 knots and showery weather at 2330 hrs. I.S.T. of 19th.

The low pressure area became well-marked on 20th morning. At 0830 hrs. I.S.T. Nancowrie reported south-southeasterly winds—5 knots, Car Nicobar southeast—

5 knots, Port Blair east—5 knots, Cuddalore north-north-west—5 knots and Baticolla northwest—5 knots. S.S. Mapia (Lat. 14° 18'N., Long. 83° 06'E.) reported north-easterly winds—13 knots at 0630 hrs. I.S.T. On the evening of 20th, the low pressure area deepened further and had moved into the southwest Bay, as the following observations indicate.

TABLE 17

Name of ship/station	Position		Hour of obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Dirn.	Speed (knots)	
S. S. Maharaja	11 06	87 06	1730	SE	15	
S. S. Lichfield	11 48	84 42	1730	E	15	
S. S. Jalaratna	13 24	84 12	1730	E	5	Drizzle during preceding hour.
S. S. Jalapratap	08 42	82 00	1730	N	4	Showers of rain during preceding hour.
Trincomalee . . . . .	..	..	1730	NNW	15	

By 0830 hrs. I.S.T. of the 21st, a depression formed in the southwest Bay with centre near Lat. 11½°N., and

Long. 83°E. The following observations of 21st are significant in this connection.

TABLE 18

Name of ship/station	Position		Hours. of obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Dirn.	Speed. (knots)	
S. S. Rajula	08 24	88 12	0530	SSW	20	
S. S. Maharaja	11 48	84 48	0530	SE	15	Moderate intermittent rain.
S. S. Jalaratna	11 54	83 42	0530	SE	6	Drizzle during preceding hour.
Madras . . . . .	..	..	0830	N	10	
Nagapattinam . . . . .	..	..	0830	NW	5	

Widespread and locally heavy rain had commenced along the Coromandel coast and in Ceylon. Ongole reported 3", Madras 4" and Cuddalore and Pamban 5" each on the 21st morning. The depression moved north-west and at 1730 hrs. I.S.T. was centred near Lat. 13°N. and Long. 82°E. S.S. Maharaja (12° 36'N., 82° 30'E.) reported southsouthwesterly winds—18 knots. Pressures were falling rather rapidly over the north Coromandel coast and Nellore reported a pressures deficiency of 5 mbs., while over the Circars coast pressures were still above normal. The depression continued to move northwest as it weakened and lay close to coast near Nellore at 0830 hrs. I.S.T. on 22nd morning. Heavy to very heavy rain had occurred on the south Circars and north Coromandel coast. Kakinada reporting 8", Masulipatam and Ongole 7" each, Nellore 6" and Madras 3" during the 24 hours ending at 0830 hrs. I.S.T. of 22nd. The maximum pressure deficiency was still observed at Nellore and was of the order of 4 mbs. The depression thereafter weakened further and on the 23rd morning lay as a diffuse low over Tamilnad and adjoining areas. Moving westwards slowly across the south Peninsula during the course of the next two days, it lay over the east central Arabian Sea on the 25th and persisted there till the end of the month and filled up

thereafter. Statement of district averages and noteworthy amounts of rainfall associated with the depression is given below.

TABLE 19

State and district	District averages on			Particularly heavy falls
	21	22	23	
<i>Coastal Andhra</i>				
Visakhapatnam	2.1	On 23rd—Polavaram 5.0".
East Godavari	2.5	1.0	On 22nd—Peddapuram 5.3", Kakinda 7.6", Coringa 5.0", Sakkinetipalli 6.3", Yerrapontavaram 7.2".
West Godavari	3.0	1.0	On 22nd—Palacole 5.5", Lakshmipalem 5.3".
Krishna	3.2	..	On 22nd—Bandar 7.2", Pandraka 7.1", Manginipudi 5.6", Nimmagadda Lock 5.3", Puligadda I.B. 5.9", Kodur I.B. 6.2", Kothapalem I.B. 5.0", Tidal Lock 8.6", Akkumarru 6.0", Kamalapuram 5.2".

TABLE 19—contd.

State and district	District averages on			Particularly heavy falls
	21	22	23	
<i>Coastal Andhra—contd.</i>				
Guntur	2.6	..	..	On 22nd—Ongole 7.1", Kanuparthi 5.3".
Nellore	2.7	5.0	..	On 21st—Iskapalli 8.9", on 22nd—Udayagiri 5.7", Pakala 6.1", Kan- dukur 5.9", Nellore 6.3", Krishnapatnam 6.2", Gudur 7.1", Rapur 5.2", Venkat- giri 9.7", Tada 5.4".
<i>Tamilnad</i>				
Madras	3.8	2.0	..	
Chingleput	2.9	2.1	..	On 21st—Pisattur 7.1".
Chittoor	1.2	2.6	..	On 21st—Pakala 6.5", Kupam 6.1", On 22nd—Tiruttani 8.3", Puttur 6.5", Kalahasti 7.4".
North Arcot . . . . .	..	1.2	..	
South Arcot	1.5	..	..
<i>Travancore-Cochin</i>				
Kottayam division	1.9	1.1	..	On 21st—Santapara 6.0".
Quilon division	1.3	1.3	1.8	
Trivandrum division	1.3	1.1	..	
Cochin division	2.0	1.2	..	
Malabar	1.3	..	..
Nilgiris	1.2	..	..
Coorg	1.1	..	..
<i>Rayalaseema</i>				
Cuddapah	3.4	..	..	On 22nd—Badvel 6.1", Chitval 5.4".
Kurnool	1.1	1.1	1.1	

11. Depression in the Bay of Bengal—1st to 10th November 1953.—Conditions became unsettled in the southeast Bay and adjoining Andaman Sea on the morning of 1st November. Pressures were falling in the Bay Islands but were rising on the Burma coast as well as on the east coast of India. Fairly widespread rain had occurred in the Bay Islands. S.S. Jalakendra (Lat. 15° 0' N., Long. 87° 12'E.) reported northnortheasterly winds—16 knots, while S.S. Nikania (Lat. 8° 42' N., Long. 85° 30'E.) and S.S. Rajula (Lat. 8° 18' N., Long. 87° 36'E.) both reported northwest—13 knots at 0530 hrs. In the afternoon of the same day, pressures were falling over the Tennesserim coast as well as the Bay Islands. By the second evening, pressure began to rise further on the north Tennesserim, Deltaic Burma and the northern parts of the Bay Islands, while pressures continued to fall on the southern parts of the Bay Islands. On the 3rd morning, the unsettled conditions became well-marked and a depression was forming in the southeast Bay with central region near Lat. 11° N. and Long. 92° E. At 0530 hrs. I.S.T. S.S. Nikania (Lat. 13° N. and Long. 91° 30'E.) reported eastsoutheasterly winds 5 knots and S.S. Gujrat (10° N. and 87° 18'E.) reported northwest—10 knots and continuous drizzle. At 0830 hrs. I.S.T. Port Blair reported eastsoutheasterly winds—5 knots and continuous rain. By the 4th morning, a depression had formed and was centred at 0830 hrs. I.S.T. near Lat. 11½° N. and Long. 91½° E. S.S. Islamia (14° 18' N., 87° 06'E.) and S.S. Worcestershire (10° 48' N., 88° 18'E.) reported north—13 knots and westnorthwest—18 knots respectively at 0530 hrs. I.S.T. and Port Blair reported eastsoutheast—5 knots at 0830 hrs. I.S.T.; S.S. Burma Sapphire (12° 36' N., and 89° E.) reported northnortheast—14 knots at 0930 hrs. I.S.T. The pressure deficiency at the centre of the depression was estimated to be 6 mbs. The depression moved in a northwesterly direction and at 1730 hrs. I.S.T. of the same date was centred near Lat. 12½° N., Long. 91° E. The following observations are significant in this connection.

TABLE 20

Name of ship/station	Position		Hours of obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Dirn.	Speed (knots)	
Port Blair	—	—	1730	S	10	
Maya Bandar	—	—	1730	SSE	5	
Table Island	—	..	1730	SE	15	
S. S. Islami	16 18	88 12	1730	NNE	18	
S.S. Steel Scientist	16 00	86 30	1730	N	20	
S. S. Burmah Sapphire	13 34	87 57	1730	N	15	Continuous rain.

At 0830 hrs. I.S.T. on the 5th, the depression was centred near Lat. 13° N., Long. 90° E. when S.S. Clan Mackendrick (14° 54' N., 87° 24'E.) reported northerly winds 18 knots; S.S. Burmah Sapphire (15° 04' N., 86° 18'E.) reported north—20 knots and S.S. Worcestershire (7° 36' N., 83° 36'E.) westnorthwest—15 knots at 0530 hrs. I.S.T. The depression continued to move in a northwesterly direction and at 0830 hrs. I.S.T. on the 6th was centred near Lat. 14° N., Long. 89° E. S.S. Jalaveera

(16° 42' N., 84° 06'E.) reported northnortheasterly winds—22 knots and S.S. Jalapratap (14° 18' N., 85° 30'E.) northerly—15 knots at 0530 hrs. I.S.T. Moving northwest it deepened, the negative pressure departure along the Circars coast being of the order of 6 mbs. on the 7th morning. At 0830 hrs. I.S.T. it was centred near Lat. 15° N., Long. 87° E. as the following observations indicate.

TABLE 21

Name of ship	Position		Hours of obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Direction	Speed (knots)	
S. S. Maharaja	14 18	91 12	0530	S	18	
S. S. Jalapratap	16 36	86 30	0530	ENE	20	Shower within last hour.
S. S. Jalaveera	18 12	85 36	0530	NE	24	Rain within last hour.
S. S. Nurani	18 42	85 06	0530	NE	24	
S. S. Urbino	12 05	84 20	0700	W	25	Overcast. Heavy rain swell north- erly becoming confused.

The deep depression continued to move northwest and at 0530 hrs. on 8th was centred near Lat. 16°N., Long. 86°E. The following observations of the 8th are relevant in this connection.

TABLE 22

Name of ship	Position		Hours of obsn. IST	Wind		Remarks
	Lat. °N.	Long. °E		Direction	Speed (knots)	
S. S. Maharaja	18 18	89 30	0530	SE	14	
S. S. Burmah Sapphire	18 35	85 53	0830	NE	25	
S.S. Wairata	13 54	85 18	0530	W	13	

The estimated pressure deficiency at the centre of the depression was about 10 mbs. By 1730 hrs. on the same date, the deep depression weakened and was centred near Lat. 17°N., Long. 85½°E. At that hour, S.S. Burmah Sapphire (19°18'N. and 86°20'E.) reported easterly winds—20 knots and S.S. Jalaratna (13°30'N., 85°36'E.) reported westsouthwest—13 knots with moderate intermittent drizzle. By the next morning (9th) it weakened further and lay as a shallow depression near Lat. 18°N. and Long. 85°E. Pressures began to rise at most places along the east coast and the pressure deficiency at the centre of the depression was estimated to be about 6 mbs. At 0830 hrs. I.S.T. of that morning, Visakhapatnam reported northerly winds—15 knots, Gopalpur northnortheast—13 knots and S.S. Karmala

(Lat. 18.6°N. and Long. 86.0°E.) southsoutheasterly—13 knots. Locally heavy rain occurred on the Circars and south Orissa coasts, Gopalpur recording 4" and Puri 7" during 24 hours ending at 0830 hrs. I.S.T. of 9th. On the morning of 10th, it lay close to the Circars coast as a low pressure area and subsequently became unimportant. Under the influence of the depression, fairly widespread rain with locally heavy falls occurred along Bengal—Orissa coast during the period 8th to 11th, in coastal Andhradesa on 10th and in Chota Nagpur on 11th. A statement of district averages and particularly heavy amounts of rainfall associated with the depression is given below. The rainfall figures for Orissa are not available.

TABLE 23

State and district	District averages on										Particularly heavy falls
	1	2	3	4	5	6	7	8	9	10	
<hr/>											
<i>West Bengal</i>											
Bankura	1.2	
<i>Chota Nagpur</i>											
Manbhum	On 10th—Purulia	10.2.

12. Deep depression in the Bay of Bengal—22nd to 27th November 1953.—An easterly wave moved into the south Andaman Sea on the 17th November as indicated by the backing of upper winds at Port Blair from east-northeast to northnortheast and fall of pressure in south Bay Islands and on the Tennasserim coast.

A low pressure area formed over the south Andaman Sea by the 18th morning, when Car Nicobar recorded 3" of rain between 0830 hrs. to 1730 hrs. I.S.T.

The low pressure area slowly moved westwards becoming accentuated at the same time. On 20th widespread and locally very heavy rain fell in the Bay Islands, Long Island recording 5". By the 22nd a well-marked trough of low pressure was seen over the southeast Bay of Bengal, with an upper air circulation extending at least up to 10,000 ft. a.s.l. By the same evening, it concentrated into a depression with its centre near Lat. 10½°N. and Long. 92°E., the pressure deficiency at the centre of the depression being about 4 mbs.

The following observations of 22nd are significant | in this connection.

TABLE 24

Station	Hour of obsn. IST	Wind		Weather
		Direction	Speed (Knots)	
Port Blair	0830	E	15 Gusty	Slight continuous rain.
Car Nicobar	0830	WSW	10	Showers.
Maya Bandar	0830	NE	20	Heavy continuous rain.
Port Blair	1730	E	20 gusty	Slight continuous rain.

Moving in a westerly direction it was centred near Lat. $10\frac{1}{2}^{\circ}$ N. and Long. 89° E. at 0830 hrs. I.S.T. of 23rd, when Port Blair winds had veered to southeasterly—5 knots and slight continuous rain was persisting there.

Continuing to move west the depression became deep and at 0830 hrs. I.S.T. of the 24th was centred near Lat. $10\frac{1}{2}^{\circ}$ N. and Long. $86\frac{1}{2}^{\circ}$ E. The following observations are significant in this connection.

TABLE 25

Name of the ship	Position		Hour of obsn. IST	Wind		Weather
	Lat. °N	Long. °E		Direction	Speed (Knots)	
S. S. Jalamayur	12.0	84.0	0530	NNE	25	Shower in last hour.
S. S. Yohikok Maru	13.6	87.5	1130	E	20	
S. S. City of Durham	13.9	84.9	1130	NE	25	
S. S. Austuries	06.0	85.6	0530	W	10	
S. S. Jalmayur	10.6	83.2	1730	N	23	Moderate intermittent rain and heavy swell.
S. S. Bharat Vijaya	11.35	84.40	0630	N	6 B.F.	

The estimated deficiency of pressure at the centre of the depression was about 8 mbs.

The deep depression continued to move westward and was centred near Lat. $10\frac{1}{2}^{\circ}$ N. and Long. $82\frac{1}{2}^{\circ}$ E. at 0830 hrs. I.S.T. on the 25th. S.S. Jalayamuna (Lat. $10^{\circ}52'$ N. and Long. $82^{\circ}45'$ E.) reported eastsoutheast—25 knots at 1130 hrs. I.S.T. while S.S. Jagrani (Lat. 9.7° N. and Long. 83.5° E.) reported west—8 knots at 1030 hrs. I.S.T. During the course of the day, it weakened and taking a westsouthwesterly course towards the Palk strait, was centred about 60 miles to the south of Nagapattinam at 0830 hrs. I.S.T. of the 26th. At that time,

Nagapattinam reported northeasterly winds—15 knots, Pamban—northwest—20 knots and S.S. Umaria (Lat. $9^{\circ}36'$ N. and Long. $81^{\circ}24'$ E.) reported south—12 knots. By the same evening, the depression weakened further into a low pressure area which slowly moved away westwards.

In association with the depression, fairly widespread rain occurred in Tamilnad and Travancore-Cochin between the 26th and 29th. The following table gives the district averages and noteworthy amounts of rainfall associated with the depression.

TABLE 26

State and district	Dist. averages on						Particularly heavy falls.
	22	23	24	25	26	27	
<i>Tamilnad</i>							
Madras	2.4	1.1	
Chingleput	1.6	..	26th —Covelong 4.1".
South Arcot	27th —Srimushnam 5.0".
Tirunelveli	1.5	27th —Arsadi 4.5", Kayattar 4.3".

II. ACCOUNT OF WESTERN DISTURBANCES DURING 1953.

The western disturbances and their secondaries which moved across north India during January were generally active and caused an excess of precipitation over the country outside the Peninsula. Those in February, March and April were generally feeble and their

activity was confined to the extreme north of the country. Some of the western disturbances and their secondaries during the month of May and June caused local dust-storms or dry thunderstorms over the plains of north India. A list of 63 western disturbances classified according to the nature of precipitation caused by them is given in the table below. A detailed account of one active western disturbance in January 1953 is also added.

TABLE 27
Number of Western disturbances

Nature of precipitation	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Widespread	6	1	..	1	..	..	..	..	1	..	..	1
Local	2	1	1	2	4	..	..	..	..	..	2	1
Little or no rain	1	6	5	2	6	4	2	..	4	3	5	2
TOTAL	9	8	6	5	10	4	2	..	5	3	7	4

Western disturbance during the 13th to 17th January 1953.—A western disturbance appeared over north Baluchistan on the 13th January and moved into northwest Rajasthan and the Punjab (P) on the 14th. Taking a northeasterly course it moved away across the Punjab hills by the 16th. A secondary low appeared over north Madhya Bharat and neighbourhood on the 15th. It moved eastnortheastwards across southeast Uttar Pradesh, Chota Nagpur, Bihar and Sub-Himalayan West Bengal and then broke up against the eastern Himalayas by the 17th. In association with the western disturbance and its secondary, widespread thunder-rain occurred in Uttar Pradesh and the Punjab(I) on the 15th and over the belt extending from the Punjab(I) to Gangetic West Bengal and Assam on the 16th. Widespread thunder-rain continued in northeast India on the 17th

also. Some of the noteworthy amounts of rainfall recorded on 16th morning were—Ambala 4", Nainital 3" and Dharamshala, Bahraich, Gonda, Naya Dumka, Lucknow, Najibabad and New Delhi 2" each. There was widespread and heavy snowfall over the Punjab-Kumaon hills on the 15th and 16th causing disruption of communication in Simla and other hill stations. In some localities, snowfalls occurring continuously for nearly 72 hours were reported to have caused serious dislocation of normal life. Some of the thunder-storms in east Uttar Pradesh were accompanied by hail and were reported to have caused damage to crops.

In the wake of the western disturbance, cold air swept in and a large drop (6 to 10°F.) in the night temperature took place over north India between the 16th and the 18th.

III. LOCAL STORMS 1953

Of the local storms reported in the newspapers, the following are noteworthy :—

Place	Date	Time	Classification of storm	Loss of human life	Remarks
1 Kurseong	21st Jan.	Morning	Hail storm	..	Small particles of hail stones rained for over half an hour.
2 Muzaffarpur } Monghyr } Purnea } Patna }	23rd Jan.	..	Severe hail storm	..	Hail storm caused considerable damage to standing crops.
Parts of the districts					
3 Agartala	13th Mar.	Night	Nor' wester	16	Orinent Airways Convair with 11 passengers and a crew of 5 crashed on top of a peak about 30 miles south of Kailashahar and 25 miles east of Agartala, when caught in Nor' wester gales.
4 Cooch Behar	13th Mar.	Night	Nor' wester	1	Severe gales hit Cooch Behar and 200 were injured. Wind speed 60 m.p.h.
5 Gauhati.	13th Mar.	Evening	Severe storm	..	Storm uprooted trees and blew off roofs of many houses. Electric supply was cut off. Caused heavy damage to communications of the State.
6 Karimganj	13th Mar.	Night	Nor'wester	1	Gales hit between 9 P.M. and midnight, wind speed reaching 60 m.p.h. About 500 houses were flattened and 2500 people rendered homeless. 50 were injured by flying roofs. Telegraph poles and trees were knocked down.
7 Siliguri	13th Mar.	Evening	Sever storm	..	Caused heavy damages to 50 houses. A loose loaded wagon was driven by the strong wind to a point 4 miles off Siliguri and collided with a passenger train. The engine derailed resulting in serious injuries to the driver and fireman.
8 Darbhanga	14th Mar.	Severe	hail storm	..	Severest hailstorm in 15 years, followed by rain. Rabi, Mango and Lichi crops were badly damaged. Many big trees were uprooted and roofs of thatched houses blown away as a result of which several persons were injured.
9 Gorakhpur, Deoria and Basti dists	14th Mar.	..	Afternoon Severe thunder storm	2	Two villagers were killed and cattle injured as a result of lightning stroke. Considerable damage was also caused to crops.
10 Dibrugarh	19th Mar.	..	Storm	..	A number of trees were uprooted and telegraph and telephone services affected.
11 Urunabund (Assam)	22nd Mar.	..	Storm	6	6 persons were killed in Urunabund Tea Estate, under the debris of a house.
12 Gauhati	25th Mar.	Night	Severe hail storm	..	Caused extensive damage to standing crops. Paddy crop ready to be harvested and huge quantity of budding green tea leaves were affected.
13 Domohani (Assam)	7th Apr.	..	Severe cyclone accompanied by rain and hail.	..	Caused heavy damage to houses.
14 Jalpaiguri	7th Apr.	Evening	Do.	4	25 injured of whom 4 died as a result of roof collapse. Telephone and electric supply dislocated and damage of over Rs. one lakh was caused. Velocity of the storm was 80 m.p.h. Some of the hailstones measured 5 in. diameter.
15 Karimganj	7th Apr.	Night	Hail storm	..	Many houses and Govt. buildings were damaged.
16 Mayanguri(Assam)	7th Apr.	..	Severe cyclone accompanied by rain and hail.	..	Caused heavy damage to houses.
17 Silchar	10th Apr.	Night	Cyclonic gale and rain.	..	Electric supply was dislocated. Several people were injured.
18 Banaras	18th Apr.	..	Dust storm	1	A portion of masonry from the top of a house fell killing a man.
19 Allahabad	19th Apr.	Afternoon	Dust storm followed by hailstorm.	..	Uprooted trees and caused dislocation of electric and telephone communications. Storm raged at 62 m.p.h.; blew off part of the roof of the Flying Control and tin sheds from some houses.

	Place	Date	Time	Classification of storm	Loss of human life	Remarks
20	Calcutta	27th Apr.	Evening	Thunder squall	..	Maximum wind speed at Alipore was 45 m.p.h. while at Dum Dum area it was 82 m.p.h. Tramway traffic was suspended for a while. Rooms of some katcha structures were blown away. Air services were also affected.
21	Telinipara (West Bengal)	27th Apr.	Afternoon	Hail storm and high winds.	..	Trees were uprooted and traffic affected.
22	Calcutta	29th Apr.	Evening	Nor'wester.	..	Several people injured when trees were uprooted and huts damaged or blown away. Wind speed was 55 m.p.h.
23	Kalna (Burdwan)	29th Apr.	Evening	Strong gale accompanied by heavy rain.	2	Trees fell and roofs of many huts were blown off and fishing boats capsized.
24	Calcutta	2nd May	Evening	Thunder squall accompanied by showers.	..	Wind speed reached 47 m.p.h. at Alipore and 62 m.p.h. at Dum Dum. Tram services were affected.
25	Jamshedpur	4th May	Evening	Gale accompanied by slight rain.	..	90 m.p.h. gale demolished 50 refugee hutments and dislocated telephone and telegraph communications.
26	Balasore	5th May	Afternoon	Storm	..	A portion of a house was demolished injuring one person.
27	Calcutta	6th May	Evening	Thunder squall	..	Wind velocity touched 70 m.p.h. Air Services were affected.
28	Vijayawada	7th May	Afternoon	Severe storm.	..	Several thatched huts were wrecked and train services, electric supply and tele-communications disrupted. The 60 m.p.h. gale snapped electric cables.
29	Calcutta	9th May	Evening	Nor'wester	1	Wind speed was 40 miles at Alipore and 86 miles at Dum Dum. Trees were uprooted and rail and road traffic was affected. Tin roofs were blown off and 12 were injured.
30	Delhi	11th May	Through-out the day.	Dust storm.	..	Road and air traffic was affected.
31	Dharampur	14th May	Evening	Storm.	1	A hut collapsed.
32	Hoogly	14th May	Evening	Storm.	1	A hut collapsed.
33	Hemari (Burdwan)	14th May	Night.	Violent storm.	6	Six persons were killed and a dozen were injured as a result of collapse of houses and falling trees during a violent storm which swept over a number of villages under Memapuri Police station.
34	Pandua	14th May	Evening	Severe storm	1	Trees fell and houses were damaged. One woman was killed by the fall of a big tree. Many were injured.
35	Calcutta	17th May	Afternoon	Storm	..	Some buildings and huts were damaged and trees uprooted during the storm that hit North Calcutta, as a result of which 5 were injured.
36	Delhi	17th May	Morning	Severe dust storm.	..	Incoming and outgoing air services were affected. Wind speed 44 m.p.h. Visibility was reduced to 400 yds.
37	Dinhata (Cooch Behar)	17th May	Evening	Gale	..	Many tin sheds were blown away and trees were uprooted. About 12 persons were injured.
38	Calcutta	2nd June	Afternoon	Thunder squall.	4	The squall sank a steam launch in Hooghly as a result of which 3 men were drowned. One boy was killed by a falling tin and nine were injured. Wind speed was 64 m.p.h.
39	Bombay	17th Oct.	Dusk	Severe thunder storm.	..	Road and sea transport was disorganised. Nearly 1 1/4" of rain was recorded in 2 hours. Wind speed was 48 m.p.h.

IV. WINDS OF FORCE NINE OR MORE IN INDIAN SEAS.

Excluding dates of storms and depressions, a description of which has been given above, winds of force

nine or more were recorded on ships in the Indian Seas during the year 1953 on the following occasions.

Month and date	Name of ship	Approximate position	
		Latitude °N	Longitude °E
21st July	S. S. Singkep	11.7	58.6
22nd July	S. S. Edinburgh	16.7	55.1
8th August	Modjokerto	12.7	54.6
11th August	S. S. Clan Bordie	12.4	57.6
11th August	S. S. Clan Bordie	12.8	56.6

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(Complete list, up to July 1957, including those Publications which are now out of print.)

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Instructions to observers at the Surface observatories, Part I (1954) Rs. 3-10-0	Departmental.
Cloud Atlas, edition 3 (1945). Rs. 2-2 or 3s. 6d.*	Ditto.
Tables for the Reduction of Meteorological Observations in India, Reprint of 3rd edition (1947).* Rs. 5-12.	Ditto.
Relative Humidity Tables (1937). As. 7 or 9d.*	Ditto.
Hygrometric Tables (1000 mb.) edition 2 (1949). As. 14 or 1s. 3d.	Ditto.
Hygrometric Tables (900 mb.) edition 2 (1955). Rs. 1-14 or 2s. 9d.	Ditto.
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Saturation Temperature Tables (1942). As. 10.	K. N. Rao.
Rainfall Registration (1956).	Departmental.
Service Instructions for Part-time Observers (1952).	Ditto.
Instructions for making entries in Pocket Register and Monthly Meteorological Register.	Ditto.
Weather Code (1955).	Ditto.
Brief Weather Code (1949). Rs. 1-6 or 2s.	Ditto.
Aviation Weather Codes (1955).	Ditto.
Codes for reporting upper Winds and Cloud Directions (1955).	Ditto.
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Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†	Ditto.
Meteorology of the Bombay Presidency (1878).	C. Chambers.
Weather and the Indian Farmer (1946).	Departmental.
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India's Climates—Summary for Airmen (1943). Re. 1 or 1s. 6d.	Ditto.
Meteorological Organisation for Airmen, M.O.A. pamphlet (1949).	Ditto.
Meteorological Conditions affecting aviation over the Northwest Frontier (1934). Rs. 1-8 or 2s. 6d.	R. G. Veryard and A. K. Roy.

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Monthly Weather Charts of the Arabian Sea and the adjacent portion of the North Indian Ocean showing mean pressure, winds and currents (1888). Rs. 5.	Sir John Eliot.
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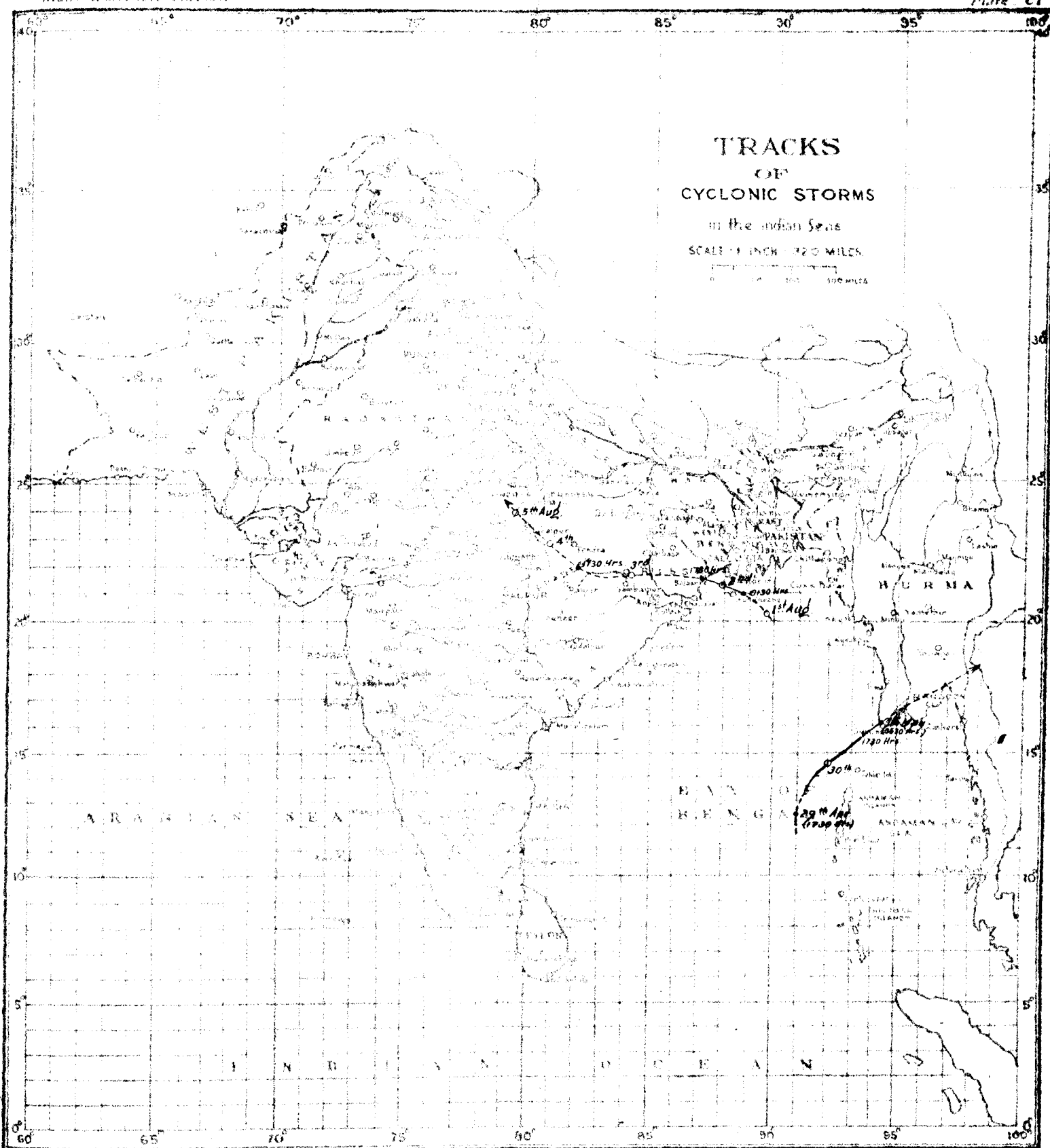
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